144

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CONTENTS.

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SCIENCE

NEW YORK, DECEMBER 2, 1893.

IMMUNITY FROM LEPROSY OF THE FIFTH GENERATION.

BY ALBERT S. ASHMEAD, M.D., NEW YORK.

THERE is a fact which, I believe, bears very directly and very strongly upon the subject of non-contagion of leprosy. It is recognized by all Oriental leprologists that every child of a leper has an inheritance of the disease, but diminished, and that after the fourth generation, if no healthy blood intervenes, the disease is entirely extinguished. There is about these matters a very interesting law in China, and consequently in Japan, the latter being, in spite of its western civilization endeavors, much more submissive to Chinese traditions than to European ideas. I find it expressed in Virchow's Archives by Dr. Friedel, in the following words:—

"No marriage with children of leprous parents is allowed. If leprosy appears in a family formerly clean, all betrothals and contracts of marriage previously entered into are rescinded as a matter of course. Only when the betrothed or married persons suffer of the same degree and type of leprosy, for instance, if they are both of the fourth degree of generation, the alliance stands. Only equal degrees of age of the morbid cases are allowed to connect themselves by marriage. A leper of the fourth generation, even if he no longer shows any external marks of the disease, can only marry a woman of the same degree of age of the disease: their offspring is free from leprosy, and no longer forbidden human intercourse."

Here we have, then, a perfect immunity acquired in four generations, and the fifth generation restores the health of the race. There is certainly a connection between this extinction of the disease and the present immunity of Europe, after that part of the world had been a prey to leprosy during several centuries of the middle ages. Evidently in the west, simple isolation has unconsciously accomplished in the lapse of time what a rational legislation tries to bring about in the east. This legislation has probably preserved the populations of China and of the east in general from entire destruction. I do not mean to say that the rule is always and carefully adhered to, because in that case the disease would be extinct now; but the rule is sufficiently known, and sufficiently adhered to, to make its salutary consequences felt.

Isolation then, and exhaustion of the pathological principle, after the course of four generations, are the only methods known to us of acquiring immunity. Wherever the disease still exists, it is the violation of that law, with which all the Oriental priests and doctors are so familiar, that has kept it alive. I had occasion about a year ago to speak of these matters, at a time when there was very much and very silly newspaper talk about the danger arising from the presence of a few poor leprous Chinamen in New York. I beg permission to reproduce here my whole article which I sent at that time to the *Tribune*, and which was published Aug. 9, 1891.

"The recent appearance of several Chinese lepers in New York, and the fact that they are permitted to pursue their avocation for a time, at least, among us, suggests to me the following points which it may be useful to consider in our conduct towards individuals of that kind, which the abundant flow of immigration may bring to our shores:

"1. Leprosy in China is very frequent; in the province of Quang-tung, of which Canton is the capital, alone, there are at least 10,000 lepers; in all the maritime provinces of the South it rages with the greatest intensity. It abounds, also, in Hankow, Central China. Outside of Canton, in its province, there are many leper villages, also along the Yang-tse-Kiang, as has been noted by several European observers. As to the interior of China, our knowledge of leprosy, of course, is derived solely from indigenous information. We know that the disease is more frequent in Quang-tung, Quang-sae, Hoonan, and Fuh-kun. In Pekin leprosy is rare. It is a generally admitted fact that it has not spread beyond the regions where it is established. Of course, it should be a rule at San Francisco to obtain information as to the part of China where the Mongolian immigrant comes from, if such a thing is possible. At any rate, might not a certificate of health be required of him?

"2. The Chinese believe that the disease may be communicated by the contamination of food. This generally received opinion must seem to us strange at first; but the fact that the lepro-bacillus is found in greater abundance in the mucous membranes about the mouth, throat, and nose lends it a certain degree of plausibility. Now, the Chinese established among us preserve, as everybody knows, all the customs of their own country. One of these customs consists in grouping together and eating their rice from the same bowl with those chopsticks which are promiscuously used by the whole house. If there is really something in the Chinese views of food infection, the necessity of isolating a leper from his countrymen is evident.

"3. The Chinese Government believes that leprosy is contagious, but it does not seem as if the people shared in this belief. There are asylums to isolate lepers all around Canton; laws and regulations have been issued with the same views. Yet, in spite of the regulations, the leper may enter any city by paying a certain sum of money, which goes to the leper fund. Altogether the Chinese act as if they did not believe in contagion. Nobody thinks of refusing to buy from a leprous huckster; provisions are bought fearlessly in the store of a leprous caterer. The disease, we may therefore admit, cannot easily be communicated by contact. Yet if there is any danger in contact, then we may be sure that the Chinese among us, true to their traditional customs, as they are, will do nothing to diminish it.

"4. But even the Chinese believe, with many other Eastern nations, that leprosy is communicated by cohabitation. Their laws recognize this fact. Some strange superstitions show how much the people are convinced of it. It is a belief among the leprous women of China that a woman affected with leprosy can be cured by cohabitation with healthy males. Whether we admit the Chinese theory, or are inclined to doubt it, we cannot absolutely condemn it, and therefore should not legal obstacles be put in the way of such intercourse between the two races? At any rate a leprous Chinese should under all circumstances be sent back to his own country.

"5. To allow the leprous male intercourse with healthy women is simply to strengthen and nourish the lepro-bacillus. The strength of the latter is gradually attenuated as lepers breed with other lepers, so that after a certain number of generations the obligate parasite is extinguished. This is the law of hereditary transmissibility, which has influenced all Oriental legislation, inasmuch as marriage between recognized lepers is permitted, while between a leper and a healthy person it is prohibited. This tendency to further disease, produced by the admixture of healthy elements, may not be apparent at the first forthcoming generation. The disease sometimes skips a generation or two and remains latent, until the third or fourth, perhaps, it meets with susceptible material. As long as there is a leper here, unrestrained in his actions, there is evidently danger of his perpetuating the disease among us.

"6. It must not be believed that we are absolutely and under all circumstances safe from leprosy. It is true that European residents in China, even where their contact with the natives is very close, catch the disease only when they un-Europeanize themselves altogether, that is, eat and live with the natives on

the most intimate terms. But then, under these circumstances, they catch the disease. As there is no danger here of such identification of the two races, we need no protection from a board of health for our own persons; but if some restraint is not put upon the intercourse of the races future generations, even here, may have to pay for the imprudence of their fathers. It seems to me that it is the duty of our National Board of Health to send back to their own country the lepers who have it now in their power to poison several generations and to establish a horrible disease, to be exempted from which we have considered hitherto a precious privilege, and thanked God for it."

It follows from all that I have said that the danger from leprosy does not arise from any contagious action, but from the continual redintegration of the disease, which results from the intercourse of lepers with healthy individuals. Contrary-wise to what would happen in syphilis, this intercourse strengthens and perpetuates the evil. As a matter of fact, no greater difference can be imagined in the etiology of two diseases than that which exists between leprosy and syphilis. I may here call the attention of all dermatologists to the well-known Colles law. According to that law, a woman who bears a child to a syphilitic man acquires perfect immunity from syphilis. Now, nobody doubts, either in China or Japan, that a leprous woman bearing a child to a healthy father acquires some measure of immunity; while the child receives and transmits the susceptibility. This is a fact diametrically opposed to those which are included in Colles law.

An assimilation, in whatever degree of leprosy and syphilis, has been made by many otherwise acute observers. Yet, what a difference in regard to contagiousness; for instance, there is in the fact that one disease, breaking out at the age of puberty, spares the race, while the other congenital, appearing with the appearance of the individual himself (both parents being supposed to be syphilitic) would destroy the race. In leprosy the intervention of pure blood acts as a nourishment to the disease; in syphilis, it attenuates the virus. The attenuation of germs, when they are allowed their regular course, seems to me to be of more general application. It is believed in Japan, that a child of parents who enjoy immunity from small-pox, by having had the disease, possesses itself a natural immunity (not a perfect immunity) transmitted to it. This was the greatest obstacle to the introduction of vaccination into Japan: artificial immunity of the parents, they said, would interfere with the natural power of resistance of the child. Variolization (if I may coin the word) and syphilization were always popular in Japan, in consequence of these same traditions. The complete devitalization of our introduced vaccine virus, after a certain series of inoculations, when a new virus had to be imported, proves that these Orientals were right. The devitalization of the germ of syphilis, which has occurred in Japan, after thirteen centuries of syphilitic inoculation, proves also that a natural immunity is acquired by the very transmission of the disease.

Let me say now what I believe must be rationally deduced from all I have said: What is generally called contagiousness does not essentially belong to the disease itself, it is entirely in the individual who contracts it. Its measure is that of the resistance of the individual or of the race. In four generations of lepers, regulated as I have said, the power of resistance becomes complete. In an unconscious, blundering, mediæval way, the resistance has been acquired by Europe. There is no place for the idea of contagion in these facts.

THE INFLUENCE OF THE MOON ON RAINFALL — A SYMPOSIUM.

I. — BY MANSFIELD MERRIMAN, PH.D., LEHIGH UNIVERSITY, SOUTH BETHLEHEM, PA.

The widespread notion regarding the influence of the moon on the weather has probably some slight validity. The dispersion of clouds in mountainous regions under the influence of a full moon has been noted by several observers, as also the peculiar movement of thunder-storms. Yet little evidence, except of a negative character, has been derived by a discussion of rainfall statistics, although the rainfall is an element probably quite as liable to be influenced by the moon's changes as other elements. A series of observations, suitable in all respects for such discussion, is indeed difficult to find. The mean daily rainfall for a locality of wide area is not adapted to this purpose, for the moon's influence cannot be supposed to be the same under different topographical conditions. Even the daily records of rainfall at a single station may not be good ones if changes occur from time to time in surrounding buildings and trees, or if the gauge is placed at different positions in different years.

The observations of rainfall, taken at Bethlehem, Pa., by Mr. F. E. Luckenbach, during 1881–1890, are selected as the basis of a brief discussion, and they are believed to be free from the objections above noted. The amount of rainfall in each year was obtained for the day of new moon and for each of the three days preceding and following, and also for the other quarters. For each year a curve of rainfall throughout a lunar month of 28 days could then be drawn, and these curves were combined in various ways to endeavor to ascertain the features common to all of them. The following conclusions were derived: First, the new moon is liable to be followed by an increase in rainfall; second, the full moon is liable to be followed by a decrease in rainfall; third, the wettest period is generally at and preceding the full moon; and, fourth, the driest period is generally at and preceding the first quarter. These conclusions are, in general, most plainly marked in the years of least rainfall.

The first conclusion, that the rainfall is liable to increase after new moon, is perhaps the one most prominently observed in the curves for all the years. The frequency of rain, as shown by the number of days on which rainfall occurred, was also found to follow the same law. In the following table are given for each of the years the amount of rainfall on the two days before and on the two days after the day of new moon, as also the number of rainy days for each period. The number of new moons embraced in the table is 124, and in the last two columns are shown the number of times that this first conclusion was verified and the number of times that the opposite fact occurred. It is seen that every year except 1889 agrees with the conclusion as exhibited in the

Rainfall for Two Days before and Two Days after New Moon.

Year.	Inches of Rainfall.		Number of Rainy Days.		Conclusion Verified.	
	Before.	After.	Before	After.	Yes.	No.
1881	0.22	3.69	2	5	5	1
1882	1.51	2.24	2	4	3	2
1883	3.07	3.14	7	8	4	4
1884	1.28	4.66	5	6	6	5
1885	1.23	2.03	7	7	4	4
1886	2.88	3.03	5	10	7	3
1887	3.07	4.75	7	11	6	3
1888	1.58	1.68	5	8	6	3
1889	6 13	1.87	7	8	4	7
1890	3.05	6.91	6	7	8	2
1881–1890	23.97	33.87	53	74	51	34
Odd years	13.72	15.41	30	39	23	19
Even years	10.25	18.46	23	35	28	15
1881–1885	7.31	16.79	23	30	22	16
1886–1890	16.66	17.08	30	44	29	18

totals. The year 1889 was the one of heaviest rainfall, 57 68 inches, while 1881 had the least rainfall, 34.99 inches, the mean for the ten years being 45.68 inches. The probabilities of the respective occurrences, if based upon the totals for the ten years, are, hence, $\frac{51}{124}$ that rainfall will increase after the new moon, $\frac{34}{124}$ that it will decrease, and $\frac{39}{124}$ that rain will not occur either in the two days before or in the two days after.

The conclusion that the full moon is generally followed by a decrease in rainfall is not as plainly marked as the above, but the following are the total amounts in inches for the two days before and the two days after full moon:—

	Before.	After.
1881–1890	36.21	27.00
Odd years	14.76	12.51
Even years	21.45	14 49
1881–1885	16.31	10 54
1886–1890	19.90	16.46

The third and fourth conclusions, that the wettest period in the lunar month is near and before full moon, and that the driest period is near and before first quarter, are distinctly marked in the several mean curves. The mean result for the ten years is that 6.1 per cent of the rainfall occurred on the day of the first quarter and the two days before, while 13.3 per cent occurred on the day of the full moon and the two days before. In inches of rainfall the results for these two periods for several groups of years are as follows:—

	Day of Full Moon and two days before.	Day of First Quarter and two days before.
1881–1890	60.80	31.78
Odd years	23.64	13.76
Even years	37.16	18.02
1881–1885	20.76	12.65
1886–1890	40.04	19.13

The distribution of rainfall at and around the time of the changes of the moon has been the element most generally studied in connection with this question. In order that the records now under review may be compared with others, the following are given for periods of one day, three days, and five days respectively. These are for the ten years 1881–1890 and in inches of rainfall.

	Day of change.	Day of change and one day before and after.	Day of change and two days before and after.
New Moon	14.62	41.77	72.69
First Quarter	9.61	32 20	60.70
Full Moon	24.59	53.43	87.80
Last Quarter	21.34	49.67	73.29

These figures, like those previously given, indicate that the maximum rainfall occurs near full moon, and the minimum near the first quarter. It is impossible indeed to avoid the conclusion that at Bethlehem, Pa., during the years 1881–1890, the distribution of the mean rainfall seems to have been arranged with respect to the changes of the moon. If the moon really influences the weather it is to be expected that a connection will also be observed in other records, but it cannot be expected that the maximum and minimum rainfall in the lunar month will be similarly situated in all cases with respect to the times of change. I venture further the suggestion that, if the moon affects the rainfall, the greatest influence will probably be found in connection with thunder storms and local showers.

II.—BY H. A. HAZEN,[1] WASHINGTON, D.C.

THERE is hardly an idea regarding the weather so firmly rooted and so widespread as this, that the moon has a rather marked effect in bringing about its changes. This paper by Professor Merriman is a very interesting contribution to the subject. I desire to add a little to what he says, as his conclusions are not the same as those reached by myself. This matter has been thoroughly investigated in England and Europe with a negative result, except that there seems to be a slight influence of the moon, or perhaps the tide, on the occurrence of thunder-storms, and that the full moon seems to have power to drive away clouds. All the feasts and festivals in Germany are at the time of full moon. This, however, may be as much for the benefit of the light as the lack of rain. In the U. S. Monthly Weather Review for October, 1885, there is a short paper, in which it is shown that over this country as a whole there is a preponderance of thunder-storms during the new moon. While in New Haven, Conn., special research on this question showed that in that place there was, from 1878 to 1880, nearly a half more rain just before and after new moon than full moon. A farther investigation for this whole country, also for 100 years at London, England, gave a negative result; that is, no effect from the phases of the moon. In 1889 an investigation on the lower California coast gave a preponderance of rain during full moon.

It has occurred to me that it would be advisable to calculate the data at Philadelphia, Pa., which is not far from Bethlehem, for this question. I first computed the data for fifteen years, 1871–1885, and afterward for the ten years 1882–1891, with the result given in the accompanying table:—

	Amount of rain day of and one day before and after.		Amount of rain day of and two days before and after.	
	1871-85	1882-91	1871-85	1882-91
New Moon	66.66	42.03	108.89	74.81
First Quarter	59.38	29.09	102.26	50.68
Full Moon	60 36	44.12	94.60	60.80
Last Quarter	55.72	47.59	101.06	64.03

It will be seen that in the first period of fifteen years there is a preponderance of rain at the time of new moon, which corroborates the result previously obtained at New Haven. In the second period, for the three days about each phase the result is similar to that of Professor Merriman, though the difference of two inches between new and full moon is very slight. When we take the five days about each phase, however, we see that the new moon has 13.5 inches more rain than the full. I do not advance these figures as proving any influence whatever. It must be almost inappreciable if there is any at all.

A word may be added regarding the influence of the moon in driving away clouds. I have detected this apparent influence many times by closely watching the moon. Of course, if this is a fact, it would show that there must be a tendency to less rain at the time of full moon. It should be borne in mind, however, that the minimum of cloudiness occurs in the evening or before midnight, and this complicates the phenomenon.

[1] As Prof. Merriman's paper has not been seen, this must be regarded as an independent discussion of the subject and not a reply to that.—H. A. H.

RECENT BOTANICAL EXPLORATIONS IN IDAHO.

BY D. T. MACDOUGAL, LAFAYETTE, IND.

IN various parts of the region occupied by the ranges, spurs and foot-hills of the Rocky Mountains are large areas which have never been explored by the naturalist. The species of the flora and fauna of such regions can, to a great extent, be approximated by a knowledge of the contiguous territory, especially if a similarity of climate prevails, but in all cases every natural area of land, such as a river, valley, or mountain range, gives to its forms of plant and animal life certain differences from all forms found in other localities. If the differences are of sufficient importance, they will constitute new species, and in many cases whole groups or genera peculiar to a certain region are found.

The exploration of certain areas invariably brings to light numerous undescribed forms of both plants and animals besides affording valuable information on the distribution and variations of known forms.

At various times collections and observations on the flora of the Rocky Mountains have been made by attachés of geographical and geological surveys, and by the various parties engaged in the exploration and survey of railroad routes across the continent, by individual workers under the direction of the several divisions of the U. S. Department of Agriculture, by representatives of various scientific societies, and by collectors working entirely independently.

The amount accomplished in this way cannot easily be estimated, but it may be suggestive to know that "The Systematic and Alphabetic Index of New Species of North American Phanerogams and Pteridophytes," published in 1891 by Josephine A. Clark, "Contributions from U. S. National Herbarium," Vol. I.,

No. 5, shows that, during the year of 1891, 677 new species and 183 new varieties of flowering and fern-like plants were described. Perhaps one-third of these are simply old forms re-arranged, but these figures indicate that more than five hundred new forms among the higher plants, with no mention of the vast number of lower forms, have been discovered in this one year. Among the areas within the boundaries of the United States unexplored by the naturalist, may be mentioned north-western Montana, northern and central Idaho. These regions have been at various times penetrated by Hudson Bay trappers, missionaries, hunters, gold and silver prospectors, but our knowledge of the topography is comparatively meagre, and the best government maps are not even approximately correct, especially in central Idaho, with which this article is particularly concerned. In general, however, the following description obtains. (See map.) The broader southern portion consists in great part of the arid "sage" plains of the Snake River Basin. The surface is chiefly basaltic lava overlying porphyritic trachyte. This entire region is characterized by excessive changes of temperature. The central portion is a huge mountain mass upreared in places to a height of 13,000 feet, reaching far above timber-line and bearing extensive banks of perpetual snow.[1]

The jagged slopes are covered with forests of cone-bearing trees, with dense thickets of underbrush on the lower slopes. The principal formations are lava, granite, and forms of limestone and quartz.

The most prominent of the numerous short ranges comprised in this group are the Salmon River, Lost River, Clearwater, Sawtooth, Pahsimeroi, Craig, and Seven Devils Mountains. Extending northward along the eastern border and joining this central mass directly are the Bitter Root ranges passing northward into the Coeur d'Alene Mountains, leaving to the westward the semi-circular basin drained by the Clearwater and Palouse Rivers and by the tributaries of Lake Coeur d'Alene.

North of the 48th parallel, Clark's Fork of the Columbia River cuts its way through the ranges and expands into Lake Pend d'Oreille, a cliff-encircled sheet of water, forty-five miles long and ten miles wide, with a depth of 1,800 to 2,500 feet. Northward, between the forks of the Columbia River, are the snow-capped mountains surrounding the elevated Lake Kaniksu.

For the season of 1892, Dr. Geo. L. Vasey, chief botanist of the Department of Agriculture, planned a survey of the basaltic basins of the Clearwater and Palouse Rivers, the country around the lakes Coeur d'Alene and Pend d'Oreille and the adjoining mountain ranges to the eastward, and, acting under the direction of Dr. Vasey, in accordance with this plan, a party of botanists composed of J. H. Sandberg, A. A. Heller, and D. T. MacDougal, with J. G. Brunswick in charge of camp, outfitted at Lewiston at the head of navigation of the Snake River, and went into camp on the north bank of the Kooe-Kooskia or Clearwater River, April 23.

The camp equipment consisted of four native horses ("cayuses"), a mountain-wagon, harness, riding and pack saddles, a wedge tent for storage and sleeping-room, and a large wall tent for the routine work. To this may be added the usual number of woolen and rubber blankets, tarpaulins, cooking apparatus, medicine chest, fire-arms, etc. For the preparation of dried plants, 6,000 driers, 11½ by 17½ inches, and several times as many sheets of fine Manilla paper of the same size, were furnished; in addition, several packages of envelopes, for the reception of seeds and small plants; portfolios, tin boxes for collecting specimens, a varied assortment of picks and large knives for uprooting plants from soil and rocks; note-books for the accumulation of data concerning the habits and distribution of plants, and movements of the expedition, and an aneroid of doubtful accuracy and limited usefulness. The general plan of work was to pitch the main camp in a favorable location, generally near a stream or lake, where good forage, fuel, and water might easily be obtained. From this place as a centre, the immediate neighborhood within a radius of three or four miles would be worked over; this area would then be extended four to eight miles farther by the use of saddle animals, the collector returning to camp each day. Still more extended excursions, so far as 40 miles in some cases, were made by boats and pack-horses carrying the smallest necessary camp outfit and a minimum of apparatus.

All flowering plants collected for preservation were placed in the drying sheets on the same day on which collected, if possible, and a daily change of driers made until safely dried. These prepared specimens were then shipped to Washington whenever transportation was available.

After the region accessible to the camp had been thoroughly worked, the expedition would then move its entire equipment fifteen to fifty miles and pursue the same method. In this manner the route was carried from the first camp on the Clearwater River to the southern edge of its basin in the Craig Mountains about May 20, camp being made at Lake Waha. Up to this time the weather had been extremely unfavorable to field work and preparation of specimens, the journal showing that during the first twenty-five days rain and snow-storms had been encountered on twenty-three of them, it being, however, practically the end of the rainy season. At Lake Waha (elevation 2,500) the nights were extremely cool, and on the slopes a few hundred feet above it were huge snow-banks, in many cases a dozen feet thick. From Waha the expedition retraced its steps to the Clearwater camp, then up the Clearwater and its northern tributary, Potlatoh Creek, making two camps on this stream and its branches. From here the route was through well-settled districts northward to the south-western part of Lake Coeur d'Alene, which was reached July 2, camps having been made near Moscow, Viola, and on Pine Creek. The expedition was joined at Moscow by Mr. G. B. Aiton, who participated for three weeks in the excursions made to the lower ranges on the east and isolated buttes in the basin. From the camp at Farmington Landing numerous bays and tributaries were explored by boat, and, by aid of one of the small steamers plying here, an excursion was made up the Coeur d'Alene River, and half the party ascended the St. Joseph River to near the head of navigation, forming a temporary camp near the base of Wessner's Peak at the ranch of Mr. C. P. Reid. An ascent of the mountain was accomplished July 6. Ice was found on lake near the summit, while snow-fields were numerous

[1] Dr. C. H. Merriam, "North American Fauna," No. 5.

and extensive although its highest part is far below timber-line. The expedition moved across the lake and passed Coeur d'Alene City, making a short stop on the north bank of the Spokane River, then northward, across a stretch of level prairie and the Northern Pacific Railroad, to the foot of a group of mountains whose highest peak is called Mt. Carlton. Sucker, Tesemini, and Fish Lakes were visited and some ascents were made.

In the latter part of July the camp was carried to the southwestern part of Lake Pend d'Oreille and located on the ranch of Mr. J. Lieberg, a miner and botanical collector who was of material assistance to the expedition in the excursions with packhorses made from this point to the mountains near the headwaters of the North Fork of the Coeur d'Alene River and to the top of Packsaddle Mountain on the eastern shore of the lake. The work here was carried on under great difficulties. The mountain slopes are very irregular, traversed by numerous cross cañons and covered with forests of spruce, fir, and pines, which have been in many cases invaded by fires throwing to the ground thousands of trees with the trunks lying across at every conceivable angle, forming extensive breastworks, which on the lower slopes are thickly grown with Ceanothus and higher with Menziesia so thickly as to form a nearly solid wall. A passage through such places was effected only by the liberal use of the axe — cutting small trees too near each other to permit the pack-loads to pass and logs too high to be taken by the pack animals. At times an animal would attempt to pass between rocks or trees narrower than the load, or loose its footing and roll to the bottom of the cañon below, necessitating a halt and rearrangement of loads. Such occurrences wrought many accidents to apparatus, material, and temper, and oftentimes made an advance of two or three miles a very creditable day's work.

Vast forest fires were raging at this time over northern Idaho, adjoining parts of Washington and Montana; all of the valleys, cañons, and lower levels were filled with a layer of smoke so that from the double crest of Packsaddle Mountain, the tops of the neighboring peaks, as far as the eye could reach, appeared as islands in this sea of pitchy fog. These fires are of widespread prevalence and of yearly occurrence, destroying thousands of acres of forest annually and threatening, in conjunction with the extensive snow slides that descend from the higher slopes, an almost entire destruction of the timber, forestalling, to some extent, the piratical timber-thieves that infest its borders.

The final work of the season was done from the northern end of the lake from near Hope, Idaho, and here at the end of the season the camp was broken and the corps returned eastward by rail.

Briefly summarized, the results of the expedition are as follows: The basins of Lakes Coeur d'Alene and Pend d'Oreille and of the Clearwater and Palouse rivers were explored; the botanically unknown area in Central Idaho now being limited on the south by the Snake River basin, on the west by the Snake River and the basin explored. About 25,000 specimens of dried plants were collected, representing nearly 1,000 species, many of them undescribed forms. Valuable facts concerning general distribution of plants were obtained, since the area explored is one where the Rocky Mountain flora meets and intermingles with the Pacific coast flora in a very interesting manner, while the opportunity afforded by numerous mountain slopes for the furthering of some problems of vertical distribution was not neglected.

BIRDS THAT SING IN THE NIGHT.

BY DR. MORRIS GIBBS, KALAMAZOO, MICH.

WE have no regular night-singers in Michigan, and, so far as I am able to learn, America does not equal the Old World nightingale, although we have diurnal songsters which excel. The famous English naturalist, Gilbert White, records three species of birds which sing at night in the British Isles. They are the reed-sparrow, which sings among the reeds and willows, the woodlark, singing in mid-air, and the nightingale, as Milton describes it,—

"In shadiest covert hid."

There are several species of owls which roll forth or screech out their notes at night, and also numerous shore-birds and waterfowl that issue their varied calls, and, especially these latter, are to be heard during the season of migration, as most birds are partial to night travel spring and autumn. Then, too, our well-known whip-poor-will confines his not unmusical, but monotonous jargon to the hours of darkness, while the scream of the night-hawk breaks on the ear between the setting and rising of the sun. But these birds are not, strictly speaking, songsters, although their notes undoubtedly fill their requirements as to harmony and expression.

The plain, domestic little chipping sparrow sometimes favors us with its simple reverberating chatter in the darkest of nights. The notes hardly deserve the name of song, but heard issuing from the surrounding gloom, the simple refrain commands our attention from its oddity at the unusual hour. The wood-peewee not rarely quavers forth its plaintive effort, sounding in the deep shade like a wail from a departed spirit. This favorite singer is a remarkably early riser, as he is also late in going to rest, and I have sometimes thought that his musical efforts at night were the result of an error on his part — an idea strengthened by the fact that the notes are rarely heard more than once during the night, and moreover the song is only occasional.

Two others, which are sometimes heard to burst forth in ecstatic melody, are the hermit and Swainson's thrushes. They are transients in my locality, but nest to the north of us. If I could describe the songs of birds, so that others could appreciate them as I do, I would feel that a partial acknowledgment had been made to the divine melody issuing from these birds' throats.

We often hear that the best singers are the ones of plainest plumages, but this is assuredly not so in all instances. If one is permitted to listen to the sweet song of the scarlet tanager in the night, it will be acknowledged that the brilliant coat of the songster does not compare in point of excellence to the owner's refrain.

These birds are the only species which sing during darkness, in Michigan, that I have met with, and not one of them is a regular night-songster.

NOTES AND NEWS.

THE College of Physicians of Philadelphia announces that the next award of the Alvarenga Prize, being the income for one year of the bequest of the late Señor Alvarenga, and amounting to about $180, will be made on July 14, 1893, providing that an essay deemed by the committee of award to be worthy of the prize shall have been offered. Essays intended for competition may be upon any subject in medicine, but cannot have been published, and must be received by the secretary of the college on or before May 1, 1893. The Alvarenga Prize for 1892 has been awarded to Dr. R. H. L. Bibb of Saltillo, Mexico, for his essay, entitled "Observations on the Nature of Leprosy."

— W. J. Waggener, Professor of Natural Philosophy, State University of Colorado, Boulder, writes: "During the present year, I have tried the experiment of making diagrams and pictures for projection by the magic and the solar lantern by printing the same with the ordinary printing press and engraved blocks, on sheets of transparent gelatine. The results were gratifying even beyond the expectations which I had long entertained for the process. It is safe to say that by this means excellent lantern-slides from diagrams and engravings of nearly if not quite all kinds can be made and multiplied as rapidly and almost as cheaply as paper prints. Having assured myself of the usefulness and the novelty of the process, I wish that its use may bring the unlimited benefits and pleasures of projected pictures to many who cannot afford the more expensive ones now in use. Especially I hope that all schools may soon be able to make use of this means of instruction. No patent will be asked for this process, but all are invited to make free use of it."

— Macmillan & Co. announce that the recently completed edition of Foster's "Text-Book of Physiology," in four parts, is to be supplemented by the issue of an appendix on "The Chemical Basis of the Animal Body," by A. Sheridan Lea, Sc.D., F.R.S. Dr. Lea is lecturer on physiology to the University of Cambridge, England.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

STATISTICS OF THE MISSISSIPPI RIVER.

BY H. L. WHITING, WASHINGTON, D.C.

PERSONS familiar with the range of tide along the seaboard can hardly realize how much the waters of our great interior rivers are affected by the rainfalls and watershed upon and from the vast surrounding valleys. The records of the Mississippi River Commission give much relevant data in regard to these phenomena. The following figures have been selected, from the voluminous reports of the Commission, to give more briefly a knowledge of facts that do not come before the general public. As an instance of the great rise and fall of the Mississippi River at Cairo — at its confluence with the Ohio — in the spring of 1891, at its low-water stage, the surface of the river was within a few inches of the top of the levee that protects the city of Cairo from inundation, and from the deck of the steamer the writer looked down into the streets of the city several feet below the line of the water rushing by with a velocity of nearly seven miles an hour. In the fall of the same year, at the low-water stage of the river, the steamer, at the same place, was fifty-one feet below the elevation at which she floated six months before; and this was not the greatest range of the river at this point.

Difference between highest and lowest water-readings.

Mississippi River.	
St. Louis, Mo	37.1 feet.
Cairo, Ill	53.2 "
New Madrid, Mo	41.4 "
Memphis, Tenn	34.5 "
Helena, Ark	48.0 "
Mouth of White River, Ark	48.4 "
Greenville, Miss	40.8 "
Vicksburg, Miss	51.1 "
Natchez, Miss	49.9 "
Mouth of Red River, La	48.5 "
Baton Rouge, La	36.0 "
Plaquemine, La	29.9 "
College Point, La	33.7 "
Carrollton (New Orleans)	15.9 "
Atchapalaya River.	
Simmsport, La	38.3 "
West Melville, La	30.4 "
Red River.	
Shreveport, La	25.5 "
Alexandria, La	40.2 "
Barber's Landing, La (Head of Atchapalaya)	51.1 "
Arkansas River.	
Little Rock, Ark	31.0 "
Pine Bluff, Ark	29.5 "
White River.	
Jacksonport, Ark	33.9 feet.
Clarenden, Ark	28.8 "
St. Francis River.	
Wittsburg, Ark	44.9 "
Tennessee River.	
Florence, La	30.4 "
Chattanooga, Tenn	54.0 "
Cumberland River.	
Nashville, Tenn	55.6 "
Ohio River.	
Paucha, Ky	54.2 "
Cincinnati, Ohio	69.1 "
Louisville, Ky (Upper)	45.5 "
Louisville, Ky (Lower)	71.0 "

Areas of Overflow.		
St. Francis Basin, Commerce, Mo., to Helena, Ark. (east side of river) 6,090	2,874	sq. miles.
(west side of river)	3,216	"
Illinois, Kentucky, and Tennessee	616	"
White and Arkansas Basins (west side of river), Helena to Arkansas City	956	"
Yazoo Basin (east side of river), Memphis, Tenn., to Vicksburg, Miss	6,648	"
Macon, Boeuf, and Tennessee Basins (west side of river), Arkansas City to Red River	4,955	"
East side of river, Vicksburg to Baton Rouge	415	"
Atchapalaya Basin (west side of river), Red River to Bayou La Fourche	6,085	"
Pontchartrain Basin (east side of river), Baton Rouge to Gulf of Mexico	2,001	"
La Fourche Basin (west side of river), Donaldsonville to Gulf of Mexico	2,024	"
	29,790	

Nearly thirty thousand square miles, or three and a half times the area of the State of Massachusetts.

Although, as stated, the high-water depth of the Mississippi River at Cairo is over fifty feet, the low-water depth, on shoals and bars, does not exceed four feet. This great highway to the ocean is, therefore, at these latter seasons, practically unavailable for navigation. Ten of the large steamers of the Anchor Line, which ply between St. Louis and New Orleans, are now laid up, while the elevators of St. Louis have accumulated some nine million bushels of wheat, waiting transhipment.[1] This is but a partial showing of the importance of the improvement of the Mississippi River, in its low-water navigation, to the commercial interests of the country; aside from the injury to agricultural interests from the overflow of the lower basins of the river.

ON THE USE OF THE COMPOUND EYES OF INSECTS.

BY R. T. LEWIS, EALING, ENGLAND.

FEW subjects connected with the study of insects have given rise to more widely differing opinions than the rationale of their complex organs of vision, the physical structure of which presents to us one of the most elaborate optical combinations to be found in nature, and this, too, upon a scale so minute as to require no ordinary skill on the part of the microscopist to unravel its marvels.

Attempts to work out the problem as to what is the impression produced upon the consciousness of an insect by an arrangement so complicated have seldom resulted in satisfactory conclusions, not a few failures in this respect apparently being due to inadequately clear conceptions as to the application of the laws and phenomena of refraction to the cases in point. But whether the subject is approached from the standpoint of those who regard an organ as having elaborated itself in obedience to the necessities of

[1] November, 1892.

external conditions, or from the opposite position of those who aver it to have been designedly contrived to meet the special requirements of those conditions, it is a matter for surprise that any should have been found to express a belief that, for distinctness of vision and other purposes for which eyes are required, these specialized and elaborate contrivances are little better than optical failures. Such a notion, if capable of proof, would be a unique exception to that perfect adaptation of means to ends, which, wherever our knowledge is complete, we find everywhere else in nature.

Apart from the question as to whether the nervous structure of an insect's eyes enables it to utilize rays which are beyond the compass of our own, it is clear that the nature of light requires in all organs of vision a structure which is analogous in its optical principles; that is, there must be the means of forming an image, a sensitive screen upon which to receive it, and a connecting line along which the received vibrations may be conveyed to the ultimate seat of the sensorial impressions. Hence we find a lens, a retina, and an optic nerve to be common to all. We may also infer that the external physical requirements will be approximately the same, so that the vibrations must be of proper quality, they must be of sufficient intensity, and they must impinge upon the retina for a sufficient time to enable its sympathetic fibres to respond to and take up the impulses imparted.

The first difficulty which we meet with in approaching the subject is one which does not apply to insects alone, and therefore does not enter exclusively into present considerations.

In the case of human vision the optic angle is so small that each eye sees the same object, indeed confusion is experienced and a double image is perceived unless the optic axes are so converged upon the object as to bring its image upon the correspondingly sympathetic portions of each retina. But in the case of some animals, and in that of birds, the increase of the optic angle precludes the possibility of such co-ordination, so that an entirely dissimilar picture is presented to each eye, and a further complication is introduced in the case of the chameleon, whose eyes are capable of independent movement in every direction within the limitations of their sockets. We are unable to realize in our own minds what the effect of this may be, because, with the exception of impressions received through the sense of touch, we have no analogous experience, but we may readily conceive it to be a matter of interpretation by which the wide extension of the visual field induces the perception of a panoramic view of the surroundings; and if to eyes which are laterally situated we add also others on the vertex, with divergent axes as we find in the ocelli of many insects, we may further imagine that an extension of the panorama vertically may present a picture embracing an area of more than half a hemisphere.

But when we come to regard vision by means of compound eyes, such as we find in insects, other considerations present themselves and it is obvious that the question as to "why and wherefore" requires another answer. I should like to be allowed here to make a protest against the continued application of the term "facetted" to the corneal surface of the compound eye, as conveying an idea which is not strictly correct. At a recent conversazione I found, amongst other objects exhibited, a plano-convex lense, the curved surface of which was ground off into numerous actual facets, and visitors were invited to look through this from its plane face in order to realize the effect produced by the "facetted" eye of an insect. I need not point out that both structurally and optically this conception was entirely erroneous. The structure of the compound eye is, however, now so well known that I do not propose to enter upon it here at any length, but will merely refer to the recent researches of Professor Exner and others as showing (1) that, contrary to previous speculations, it is capable of forming a distinct image of considerable amplitude, towards which each ocellite contributes its share; (2) that in the picture so produced very many of the pictures formed by adjacent ocellites are either superposed or overlap each other in such a way that the corresponding portions of each become coincident upon the retina; and (3) that it is highly probable that the structure of the organ provides an arrangement which serves a purpose equivalent to that of the iris in the vertebrate eye, with the further suggestion of a means of focussing. Professor Exner's experiments also prove that by the intervention of the crystalline cones this composite, or "summation," image is erect, and is formed at an increased distance from the corneal surface.

Those who have access to the last edition of the late Dr. W. B. Carpenter's book, "The Microscope and its Revelations," will have noticed a reference to these researches, but it may be as well to note that the figure on page 908 appears to have been laterally inverted by the engraver, my own recollection and a rough sketch taken at the time enabling me to say that in the original photograph the letter *R* was not reversed as shown in the wood-cut, and the church faced the other way.

Assuming, therefore, that distinct and otherwise perfect vision is enjoyed by the possessors of compound eyes, it is reasonable to suppose that, if we desire to know what is the *raison d'etre* of their complex structure, we shall be most likely to find the answer, if we proceed upon lines indicated by the further assumption, that it is required to meet some special necessity arising from conditions of life which differ from those of other creatures.

Pursuing the inquiry in this direction the following considerations make it probable that such conditions may be recognized in connection with the extremely rapid movements of insects in flight.

The angular diameter of the field of distinct vision in the human eye (as distinguished from the visual angle) is much smaller than is commonly supposed, experiment shows that it varies with individuals, but, for present purposes of illustration, we will call it 10°. The inconvenience which would otherwise arise from so circumscribed an area is in practice largely compensated for by the celerity and freedom of motion common to the eyes and head, by virtue of which also we are able to neutralize the effect of our own movements, and, within certain limits, to perceive moving objects which would otherwise cross the field in less time than the minimum required for the production of a distinct retinal image. The exact duration of this period is a matter of personal equation, but may usually be taken as about $\frac{1}{10}$ of a second. Now it is a matter of common experience that when travelling in a railway train at the rate of, say, fives miles an hour, we can, with fixed vision, clearly distinguish the flowers growing adjacent to the track, but, as the speed increases, we become less able to do so, until, at 50 miles an hour, they cross the visual area too rapidly to leave more than an indistinct impression of horizontal lines. It is, however, conceivable that if, as soon as an object had traversed the field of one lens, it came successively within the scope of nine others, which, without break of continuity, would project its image upon the same portion of the retina, the persistence of the image would be increased tenfold, with the obvious result that the flowers would then be seen as clearly whilst passing them at 50 miles per hour as they would be under ordinary circumstances at one-tenth the speed.

If there is truth in this suggestion, that the use of compound eyes is to enable their possessors to enjoy distinct vision during rapid flight, it would appear to derive support from the fact that we find, as a rule, that in larvæ and in insects which are wingless the eyes are either simple, or that the ocellitæ, of which they are compounded, are comparatively few in number; whilst in those with wings the compound character is developed to its highest degree in genera whose powers of flight are most remarkable. Instances are not wanting in which the eyes of apterous females are simple, whereas they are compound in the case of the winged males of the same species.

That such extremely rapid flyers as the dragon-flies and predatory Diptera are endowed with acute and accurate powers of vision seems to require no further proof than is afforded by the unerring manner in which they strike and capture other insects which are also on the wing.

PROFESSOR SOPHUS RUGE of Dresden, an authority on matters relating to the discovery and exploration of America, pronounces Mr. Winsor's "Columbus" "the most important contribution that North America has made to the present commemoration" of 1492.

TURKISH TIME-PIECES.

BY F. A. SEELY, WASHINGTON, D C.

MANY years ago I ventured the opinion that the development of the mechanical clock was hindered for many centuries by the general use of the Roman system of hours. I am more than ever convinced of this. It is perfectly well known that prior to the Christian era trains of gearing and other mechanical expedients were in use whereby the hand of a clock could be made to travel with uniform motion on a dial. There was, to be sure, no true mechanical escapement, but Ctesibius had devised what I venture to call a water escapement, which, under certain restricted conditions, performed the true function of that element of the modern clock. But the ingenuity of the times was not adequate to the production of the varying movement necessary to keep time in a system in which the length of the hours was constantly changing; and so the clock waited many centuries until the system of hours was changed.

This subject has been brought quite forcibly to my mind by coming into the possession of a number of German and Swiss patents for clocks designed to keep Turkish time. It appears from the specifications that the Turkish system of hours is practically identical with that of ancient Rome, the day commencing and ending with sunrise, and the middle being at sunset, the two periods of day and night being divided into six hours each, which constantly vary in length with the change of season.

It is obviously impracticable to make up a railroad time-table on such a system, or to accommodate it to numerous other requirements of modern social life; and therefore the wonder is that anybody should think it worth while to construct a clock adapted to this system; but, as the patentees are in all cases residents of Constantinople, it may be inferred that, in devising these clocks, they are endeavoring to minister to a felt want of that capital.

The device employed is of the same character in all the patents, though in some automatic, in others requiring frequent attention. It consists in so adjusting the governing member (pendulum or balance-wheel) as to give it a faster or slower rate from month to month; that is to say, in the winter months, when the period from sunrise to sunset is short, to quicken the action of the movement so that the hand shall pass in proportionately less time over that portion of the dial which represents the hours of daylight than it does in summer, when the days are long. It is obvious at once that this does not accomplish the purpose sought for, and the inference is natural that in the German and Swiss Patent Offices the question of utility cannot have been raised on these applications. If the pendulum is adjusted to a slow beat in the month of June, when the hours from sunrise to sunset are long, it might measure time during the day, but that same slow beat will destroy its capability of measuring off the short hours of the night. A parallel statement is true for the month of December. For this reason these inventions are useless, though they may serve the purpose of the patentees by imposing on the credulous Moslem.

It does not seem impossible in the present state of the arts to construct a time-piece capable of marking off this kind of hours with reasonable precision. The exactness of an astronomical clock or even of an ordinary kitchen clock would be unnecessary. But the inventions above referred to do not approach a solution of the problem, the key to which is to be found in a clock presented to this Government by that of Japan at the close of the Centennial Exposition. In this the hand moves around the dial at a uniform rate throughout the year, the adjustment for different seasons being accomplished by shifting the figures on the dial. It is many years since I have seen this clock, but, as I recollect it, the top of the dial represents sunrise and the bottom sunset, the half-circumference on each side being divided into five hours by a set of figures which can be shifted in place as the seasons change so as to make the day hours long and the night hours short, and *vice versa*, the sunset hour being shifted also.

I see no great difficulty in producing this shifting of the sunset hour automatically to the right or left as the season may require, nor does it appear to me insurmountable to connect the intermediate hours with the sunset hour so that they shall be shifted proportionately with it. With such a contrivance an hour-hand moving at an equal rate over the dial would point to the true hour by Turkish time at all seasons of the year, day and night. In fact, the problem seems to me so easy of solution that I can only explain the non-appearance of such clocks in the market by the supposition that no actual demand exists for them.

NOTES UPON THE ACTION OF DRUGS AND AGENCIES UPON THE RESPIRATORY MOVEMENTS.

BY HORATIO C. WOOD, M.D., LL.D. (YALE), UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA.

THE results of a research which I have recently completed in the laboratories of the University of Pennsylvania, although bearing very directly upon practical medicine, have, I think, sufficient scientific interest to be noted in the columns of *Science*.

Hitherto, the study of the action of agencies and drugs upon respiration has been made chiefly, if not solely, by noticing their effects upon the rate of respiratory movements. It is evident, however, that increased activity of rate does not necessarily imply increased activity of function, since the respirations, though more frequently repeated, may be so shallow as to have little effect. Aided by Dr. David Cerna, now of the University of Texas, I have measured the amount of air taken in and out of the lungs of the dog under different conditions.

Emotional or nervous excitement was found to be a most potent agency; the dog seemingly expressing his feelings in his respiration as completely as a human being expresses his in his face; so that during excitement more than twice as much air is moved as during quiet. It has long been known that the dog, having practically no sweat-glands, cools himself through the respiration; and so it was found that heating the animal, by such arrangement of apparatus as not to cause pain, nor to bring hot air in contact with the lungs, nearly doubled the respiratory movement of air. Heat, therefore, is to the dog a powerful respiratory stimulant; when in excess, however, it depresses function, as it was found that if the heating were continued the air movement became almost null. The rapid respiration seen in human beings suffering from fever, indicates that they are affected by heat similarly to the dog.

Chloral was found to be a more positive, persistent, and certain respiratory depressant than the morphine salts; it always reduced the air movement, and the reduction, with repeated and increasing doses of chloral, was progressive, until finally respiration was completely arrested.

The actions of atropine, cocaine, and strychnine were studied both in the normal and in the chloralized dog. Each of these alkaloids was found to be a powerful respiratory stimulant, increasing most markedly the air movement. The rather unexpected result was reached that cocaine is probably the most powerful of the three, but that strychnine is the most persistent and certain in its action. Thus, whilst cocaine seemed to be almost powerless against overwhelming doses of chloral, the influence of strychnine never failed to be manifested.

The bearing of this research upon practical medicine is very evident. During the experimental preparation for my address before the Berlin Medical Congress in 1890, I discovered the great power of strychnine over the respiratory centres when almost completely paralyzed by chloroform or ether; a discovery which led to the universal practical use of strychnine in the treatment of the accidents of anæsthesia. Atropine has long been used in narcotic poisoning, but its value as a respiratory stimulant within the last year or two has been very seriously challenged. Our research, however, re-demonstrated its power as a respiratory stimulant. Cocaine has been used to some extent as a respiratory stimulant, but it seems to be much more efficacious than is generally thought. It was found in our research that in the deeply chloralized dog, after respiration had been brought up as far as possible by one respiratory stimulant, the second stimulant was able to still further increase the extent and power of the respiratory movements. I have apparently saved human life in respiratory failure, by adding cocaine to the strychnine which was being given in as large dose as was thought justifiable. Cocaine

and strychnine, however, have so much similarity of action upon the spinal cord that the use of one of them would probably somewhat increase any danger that may have been incurred by the administration of large doses of the other.

On the other hand, atropine has little influence upon the spinal cord, its general physiological action being quite distinct from that of cocaine or strychnine. It is therefore probable that by the consentaneous use of atropine and strychnine, or of atropine and cocaine, the physician may obtain the advantage of what, many years ago, I spoke of as the "crossed action" of drugs; the two drugs touching and reinforcing one another in their influence upon the respiratory functions, and spreading wide apart from each other in their unwished for and deletereous effects.

In conclusion, for the sake of any one who may be interested in the details of this research, it may be stated that it will shortly be published in full in the English *Journal of Physiology*.

LETTERS TO THE EDITOR.

☞ Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

Man and the Glacial Period.

A MISLEADING paragraph in Dr. Brinton's otherwise excellent review of a recent publication under the above caption,[1] in connection with the Reverend Professor Wright's response,[2] seems to demand a further word. Dr. Brinton errs in saying "As a glacialist, the author of this volume stands among the first in the country, and his long study of that remarkable period in the geologic history of our planet invests everything he says about it with uncommon authority."

Within recent years there has grown up a new branch of geologic science, which has been called by its devotees "geomorphic geology," "geomorphology," and still more acceptably "geomorphy," and which is frequently spoken of as the "New Geology." It is the function of geomorphy to read geologic history from earth-forms, as the older geology read history from deposits and their fossils. Beginning a score of years ago with Powell's conception of the "base-level," at which erosion ceases, the primary idea has extended and expanded until now the geologist not only recognizes ancient base-levels in certain topographic forms, but is able to determine from steepness of slopes and other topographic relations the rate at which erosion has proceeded in the past, and thereby the attitude and altitude of the land during earlier ages. This branch of science has been successfully pursued by a number of geologists in this country and a few abroad, and is taught in three or four universities; and it has been found of especial use in the study of glacial deposits It is, however, a sealed book to Professor Wright; not a syllable in his latest work, or in any other of his many publications, or in his public utterances before scientific societies, suggests that he is aware of the existence of the New Geology.

Within two decades the discriminating genius of Chamberlin and a score of fellow-workers in this country has thrown much light on the events and episodes of the glacial period. Largely through the application of geomorphy, it has been shown that the glacial deposits of north-eastern America represent two, three, or more distinct ice invasions occurring at different epochs in a long period, and that the earliest of these deposits is many times older than the latest — indeed the leading authorities agree that if the post-glacial period be represented by unity, then the entire glacial period must be represented by two figures. This succession of ice deposits and ice invasions is not, indeed, recognized by some of those glacialists whose observations have been confined to regions in which only a single deposit is represented; but with one or two exceptions (including our author's namesake, A. A. Wright, professor of geology at Oberlin) every geologist who has studied the marginal drift holds to the bipartite or tripartite or multipartite character of glacial deposits and glacial history. This succession is not admitted by the Reverend Professor Wright. Accordingly, his ideas concerning early man have no definite time-basis and cannot be discussed intelligently by modern archæologists — it would be as easy to discuss the opinions of an author who confounded not only all the successive dynasties recorded in the monuments and hieroglyphs of Egypt but also the works of the modern fellahin, or of a genealogist who argued that the families of a dozen successive generations dined together at the same board. As an exposition of the antiquity of man and the glacial theory, "Man and the Glacial Period" is a cry from the tombs of a dead past; it represents the primitive knowledge of a quarter-century ago, and might then have been considered authoritative; but its publication to-day is an offense to science.

Professor Wright objects to Dr. Brinton's "flippant treatment" of the Nampa figurine, and insists that a geologist who happened to detect the fraud on the ground should burden scientific literature with some detailed statement. It does not seem to occur to him that the gentleman in question avoided rushing into print simply because the fraud was too transparent to deceive geologists, who alone are competent to deal with questions concerning the geologic antiquity of man. Respectable and cultured gentlemen seem indeed to have been deceived by this alleged "find," — but they were not geologists; so, too, respectable and cultured people, including an illustrious naturalist, have been deluded by a Philadelphia adventurer with an alleged motor, — but no physicist was deceived; in like manner, intelligent and honest people have been deluded by a brazen pretender into the belief that the heavens may be frightened into tears by cannonading — but the meteorologists are not deluded; and the circle-squares and perpetual-motion inventors are abroad in the land, yet the mathematicians and the mechanicians are not deceived. And it would be folly for the physicist, the meteorologist, the mathematician, and the mechanician to rush into print and advertise each new fraud, for thereby the press would be flooded and libraries crowded, while fraud would only flourish the more for the advertising. So long as poor human nature remains as it is, the knave and the dupe we shall always have with us; and it is to be regretted that a presumably competent authority in his own specialty of theology should be willing to assume either *rôle* in another line of activity.

The author of the work has indeed visited many existing glaciers, and his observations would be of value to geologists if they could be accepted with confidence. A case in point is his measurement of the rate of flow in Muir glacier, in which he employed primitive methods and recorded a result so extraordinary as to challenge credulity. Subsequently, the measurement was repeated by Professor Reid by a superior method, with a widely different result which is in harmony with all other observations. Instead of acknowledging his evident blunder, or even passing over the matter in silence, Professor Wright has the assurance to "talk round" the issue (p. 47), and thereby impugns the excellent work of a later observer.

"Man and the Glacial Period" is published by a reputable house as one of an "International Scientific Series," and thereby acquires a respectability to which otherwise it could not aspire. Dr. Brinton has fairly, albeit charitably, shown its weakness from the standpoint of anthropology; other reviewers have shown that it sinks even lower when viewed from the standpoint of geology.[3] In other ways, too, the title-page conveys erroneous impressions as to the profession and standing of the author. Thus, he takes unto himself the title "Assistant on the United States Geological Survey." The facts are, that he was temporarily employed by one of the collaborators of the bureau largely for the purpose of testing his competence as an observer; and that the test resulted unsatisfactorily to the bureau and was brought to an end several years ago.

In brief, the world would be wiser if the book were not written.

W. J. McGEE.

Washington, D.C.

[1] Science, vol. xx., 1892, p. 249.

[2] Op. cit., pp. 275-277.

[3] E.g., Professor T. C. Chamberlin in The Dial, Vol. XIII., pp. 303-306, November 16, 1892.

Pseudaurora Borealis; or, What was It?

The observations which I am about to recount may not be new to others, but, as I have failed to see or hear of any such after several years' waiting, I communicate mine, hoping that by doing so I may call them out if there are any. The business portions of Minneapolis, Minn., had for many years been lighted by the Brush system of electricity, during which time that method of street illumination had been extended considerably in all directions, leaving, however, much more that continued to be lighted by gas and oil. I had occasion to visit the suburbs of the city under circumstances which delayed my return until a very late hour, and for a considerable portion of my way the latter method of lighting prevailed. On passing into the electrically-lighted section, my attention was arrested by the appearance of the aurora borealis, or northern lights.

It being in the month of February, and their appearance at that season by no means a rare event, while the lateness of the hour, and the severity of the cold, with the air so filled with frost as to give an appearance of a light fog, I was hastening forward as rapidly as I could on foot, when I noticed that the aurora had disappeared, but after a few steps more it reappeared. Pausing a moment, I saw there was no mistaking the fact of my seeing a genuine display of northern lights, I again went forward with the same experience of interruption. This circumstance awakened a suspicion that the phenomena were in some way to be accounted for by the presence of the electric lights, and, after another brief pause to make myself assured of the certainty of my observations, I went back along the way I had come until fully out of the zone of the Brush lights, and well into that of the gas-lamps, where I found no signs of an aurora.

Returning slowly towards and into the former illumination, all of the observations were repeated precisely as at first, until having passed a given burner, when the phenomena again ceased. After repeatedly changing my position in relation to a special burner in a northern and southern direction, during which I discovered that the phenomena was most distinct when I was observing them at or about the angle of 60° to the burner, a corresponding movement east and west gave no more facts, and after once more noting the characteristic movements of the serrated columns of partially prismatic radiations of the auroral beams along the penumbrated arc, I went on my way resolved to keep a good outlook for another such observation, but it has never come after nearly five years of waiting. If others have noticed the same, or similar phenomena, it will be gratifying, and in order, for them to say so.

P. L. Natch, M.D.

Anacortes, Washington, Nov. 3.

The Humming-Bird's Food.

For three years I have made a special study of the habits of the yellow-bellied, or sap-sucking woodpecker (*Sphyrapicus varius*), as found in the White Mountains of New Hampshire. The birds arrive in that region near the middle or 20th of April, and remain until about the middle of October. During the whole of this period they derive the more important part of their food-supply from sap-yielding holes which they drill through the bark of red maples, red oaks, poplars, white and gray birches, the white ash and some other trees and shrubs. In every instance where I have found a well-marked drinking-place established by the sap-suckers, humming-birds have been regular attendants upon it during the summer months.

I have paid hundreds of visits to these "orchards" of the sap-suckers, and have watched them for many hours at a time. By so doing I have ascertained that, as a rule, one individual humming-bird seems to acquire a sort of easement in the sap-fountains of the woodpeckers, and if another ruby-throat attempts to drink sap at his spring, violent resistance is offered.

The humming birds, at "orchards" where they are not molested by the woodpeckers, drink scores of times in the course of the long summer day. When not drinking they are usually perched on twigs a few yards from the holes, keeping their nervous heads wagging from side to side while watching for intruders. In a few instances I have seen humming-birds perch upon the bark below the holes in order to drink long without being forced to keep their wings moving while enjoying the sweet sap.

In some cases I have placed small birch-bark cups upon trees frequented by the sap-suckers and their guests, and in each such instance the humming-birds have been as quick as the woodpeckers to discover the diluted maple syrup with which the cups were filled, and to drink it in considerable quantities. I remember seeing one drink for sixty seconds, with a ten seconds' rest in the middle of the minute.

Most of the "orchards" at which I have seen humming-birds as visitors from year to year have been composed of red maples or gray birches. At one of the birch orchards I shot two humming-birds, a male and a female, in order to ascertain whether more of their kind were visiting the holes. Only nine minutes elapsed before another was at the holes drinking.

Frank Bolles.

Cambridge, Nov. 28.

Sense of Direction.

Some time in the fifties, in Oregon, a party of prospectors took a mule team, wagon, and camping equipage on a prospecting tour. In order to be correct in their local geography, and to retrace their steps should they find anything worthy of a re-visit, they took a civil engineer along, who took the bearing of every course and the distance was chained.

When they gave up the prospecting enterprise, their route had been so tortuous that they decided to take the direct route for the home camp. The engineer footed up the latitudes and departures of the courses run, and made a calculation of the course home, and all struck for the home camp. When they reached the end of their course, night had overtaken them, and they found themselves, not in the home camp, but in the woods, with no objects or land-marks that any of the party could recognize.

As the engineer took no "back-sights," or check bearings, he said that local attraction somewhere in their journey had thrown him off a little and that they were in the neighborhood of the home camp. At this, the driver turned one of his mules loose, which went directly to the camp, about three-quarters of a mile distant. As the mules were not allowed to run at large, for fear of wandering off or being stolen by Indians, this mule had never before been over that route, and must have had a sense of direction. It was a joke on the engineer which he did not relish, though it had great "staying qualities."

John T. Campbell.

Rockville, Ind., Nov. 14.

Electrical Phenomena on the Mountains of Colorado.

In *Science* for Sept. 23, Mr. O. C. Chariton describes a mountain experience, and inquires if it is common or dangerous.

The peculiar buzzing and crackling sound, the standing of the hair on end, etc., are extremely common on the mountains of Colorado. The prospectors, miners, and drivers of pack trains to the high mines (above 11,000 feet) live in the midst of these electrical phenomena, and often find much amusement in observing their effect on the average "tenderfoot," especially when lady tourists, as not seldom happens, find their long hair slip from the fastenings and stand up like the fabled head-dress of the Furies. I have repeatedly heard the sounds at elevations between 6,000 and 7,000 feet, but they are much more noticeable at higher elevations, where they are sometimes terrific. They sometimes mark the tension of the air just preceding a discharge of lightning, but in general they are harmless. I have many times noticed them proceeding with hardly any interruption while the lightning was leaping from cloud to cloud overhead. They are caused by the passage of an electrified cloud, and the effect is rather worse when one is in the midst of the cloud. On these mountains the manifestation of intense electrical phenomena is seldom seen except when there is hail or pellet snow, or the most violent summer showers; and the latter usually have hail in some part of the storm. The loudest buzzings I have ever heard came while a

hail-storm was approaching and while the peculiar shelf or cornice which projects from the base of the storm-mass was in the zenith. This shelf has a flattish and rather smooth surface on its under side and when seen from a distance appears to consist of a mass of cloud having an under-pavement of low domes or flattish billows, and the broader and more peaceful it looks, the worse is the wrath of the storm above and within it. Lightning seldom comes from it, yet it is in a state of intense electrical excitement. While it is passing, there is a loud hissing from stretched wires (not connected with the earth), a stream of sparks, and at night a glow like St. Elmo's fire. A herd of cattle can sometimes be seen in the darkest night by their own light.

The fact is, the physiolgical effects of electric induction are so common in the higher mountains, and are often so ludicrous, that we are in danger of throwing aside these phenomena as of no special scientific interest. Yet we here have a complex problem involving not only the electrified clouds and the air as dielectric, but also the electrical properties of the ground itself. Now many of the prospectors for metalliferous veins declare that the behavior of lightning on veins containing certain kinds of ores differs from the ordinary. Some of them profess to be able to know the nature of the minerals in a mountain by observing the buzzing and other phenomena on the passage of electric clouds, but it is difficult to get them to talk about it, as they appear to regard the matter as a trade secret. Even experienced prospectors leave a certain peak on the approach of severe thunder storms, they declaring their sensations of shock to be unendurable, even when the lightning does not strike the mountain. They report that stones are loosened from the cliffs and fall in dangerous fusilades down the mountain side. No doubt these are in part land-slides, but some of them are reported to take place when no rain fell, only snow or hail, or before the rain reached the place. My informants used this language: "The mountain split and threw off those rocks." I have been desirous of determining the truth of these matters by personal observation, but thus far have not found the opportunity. It is at least a supposable case that electric attraction or repulsion dislodges blocks already loosened. Have any of your readers made observations on these matters pertaining to the effects of different kinds of rocks or minerals on electric clouds, or vice versa?

Perhaps a nearly related problem is furnished by the causes (electrical or otherwise) of the restlessness and often sleeplessness and oppressed breathing that accompanies the warm westerly or Chinook winds over the mountains. GEO. H. STONE.

Colorado Springs, Oct. 24.

The Gi'a Monster.

THERE has been considerable discussion as to the poisonous character of this lizard, and of late it seems to be accepted that it is not poisonous by the scientific people from the fact that the animal has no poison-sack or fangs, this does not by any means settle the question, for many of us know by personal experience that it is poisonous, and very much so at times. There are several people almost every year in Arizona and elsewhere who either lose their lives by it or suffer intolerable agony from it, and the notion that it is not poisonous does not lessen the number of sufferers. If the animal is in its normal condition and bites a person, no harm usually comes from it. It is a very pugnacious animal and is easily excited to frenzy, and especially so when it is being captured alive; at such times it emits a yellow and very rank-smelling saliva, which, if it enters the circulation by a wound or otherwise, produces death or great suffering in human beings. One case that came under my observation was that of a young man, in Arizona, who was bitten under those circumstances and who was sick for several months and had the disintegration of the blood and the effusion of serum that so frequently occur in those suffering from a rattlesnake's bite. I have no doubt that this explanation accounts for the poisoning of people by other "non-poisonous" lizards of our arid region. I should not be at all surprised to hear that even the horned toad that the boys so delight to torment is also poisonous under such circumstances.

MARCUS E. JONES.

Salt Lake City, Nov. 10.

Grand-Gulf Formation.

I AM glad to see that Judge Johnson accepts my determination of the brackish water character of the fauna of his Pascagoula clays, as it is a matter of some importance in the genesis of the tertiary strata of the Gulf border; and I am not disposed to quarrel with him if he chooses to retain the term "formation" for them provided it is made clear exactly what he understands by that term. His original communication was somewhat obscure on both these points and by placing a species of *Venus* in the bed (which is a strictly marine genus) I was led to suppose that he regarded the bed as (not deep sea but) purely of salt water origin.

In saying that I have permitted "conjecture" "to outrun and forestall positive discovery" in my brochure of January last, Judge Johnson simply indicates that he is not aware of the material in my possession and which though published (for the most part) during the last ten days, has been nearly two years in manuscript awaiting the printer's opportunity.

My short paper on the Pliocene of the Carolinas gave merely a tabular view of the results to which seven years of field-work and study of the material collected by numerous other workers in the field had led me. This may be found substantiated in Bulletin 84 of the Geological Survey just printed, but the portion relating to Florida had been type-written for the use of Messrs. Eldridge and Jussen before they entered upon their field-work, and it is, therefore, not exact to state that the differences between the older and the newer Miocene were "established" by those gentlemen, who had the essential solution of this question in their hands to begin with, Mr. Jussen having devoted under my direction some time to the study of the Old Miocene fauna of the Chipola beds before he entered the field at all.

Hasty generalization and hasty writing of all sorts are "baneful" I willingly admit, and an excellent example of what is to be avoided by lack of haste is shown by Judge Johnson himself in the letter alluded to (p. 247).

I have nowhere asserted that the Pascagoula clays are of Chesapeake age. As a matter of fact, they have nearly the whole of the Grand Gulf series between them and the Chesapeake formation. Judge Johnson's Waldo formation comprised beds belonging to two different epochs, the typical locality at Waldo, from his own specimens, being Chesapeake, and other localities mentioned by him, in his definition of the formation, are Old Miocene. I do not know what he refers to by the expression "overlying clays" at Aspalâga on the Appalachicola River, and certainly have never "shown" them to "be Chesapeake." Aspalâga lies in the region of the oldest Old Miocene, the fossils which I have seen from there are those solely of the Chattahoochee group. On the other hand, the Miocene discovered by Johnson at De Funiak Springs and eastward to Abe's Springs on the Chipola River is not the Older Miocene but the Chesapeake, with a typical Chesapeake fauna so far as yet developed. Still further, the Chattahoochee beds of Langdon distinctly underlie the Chipola beds, so far as they have yet been identified, and the fauna, while related to that of Chipola proper, is not the same.

In short, the Miocene limestones of Florida are so closely similar that the only way of identifying them (short of continuously tracing the beds, which is for the most part impracticable in Florida) is by their fossil contents, which can only be adequately studied in what Judge Johnson calls the "closet," that is to say, a museum supplied with the literature and specimens for comparison.

As the Grand Gulf lies probably above both the Older and the Chesapeake Miocene, I fail to see how the water-bearing sands at its base can serve to discriminate or define the distinction between the two older formations. Some part of the Grand Gulf is very likely contemporaneous with part of the later Miocene, but as yet information is absolutely deficient on this point. What we have called the "upper bed" at Alum Bluff, or the "Ecphora bed" of my Bulletin 84, is typical Chesapeake Miocene, identical with that at Waldo so far as its fossils are concerned. Lithologically, the beds are quite different. As for the Hawthorne and Ocheesee beds, both contain fossils, and we have fossils from the former collected by Judge Johnson himself. For details, the enquiring reader is referred to Bulletin 84, above mentioned.

Finally, in regard to Judge Johnson's "outline of the evolution of the Florida Peninsula," I confess to being ignorant of its existence either in print or otherwise, until long after my own views had not only been verbally communicated to many members of the U. S. Geological Survey and presented to the Biological Society of Washington, but had been circulated in type-written copies for the use of Mr. Eldridge's field-party. It is proper to say that while I had for some time entertained the theoretical view of the insulation of the Eocene island of Florida, the final proof was supplied by the field observations of Mr. T. W. Stanton of the U. S. Geological Survey, while the exploration of the Chipola beds, for material by which their age was determined, and the discovery of their existence in the typical locality on the Chipola River were first made by Mr. Frank Burns of the U. S. Geological Survey; though Langdon had previously observed the lower bed at Alum Bluff, which proves to be of the same age.

Wm. H. Dall.

Smithsonian Institution, Oct. 31.

BOOK-REVIEWS.

A Course on Zoölogy. Designed for Secondary Education. By Montmahon and Beauregard. Translated from the French by Wm. H. Green. Phila., J. B. Lippincott Co. 75 cts.

The introductory books of science of Paul Bert for use in the lower schools are very well known in this country, and have been of very great value in introducing science into the lower grades of education. The above course of zoölogy by Montmahon and Beauregard is designed as a second book in the same series, and is planned to give to a higher grade of students a somewhat extensive study in zoölogy. The translation of this book into English will be of great value to many of our high schools where an elementary text-book in zoölogy is desired and one interesting to students. The plan of the book is the natural method of proceeding from the known to the unknown. It begins with an outline of the study of human anatomy and physiology, and passes from this subject to the study of the dog, the chicken, the lizard, the frog, the fish, and then to the invertebrates, beginning naturally with insects and crustacea and then passing through the lower orders of invertebrates somewhat more hurriedly. After having thus given a general study of a type illustrative of each of the large groups of animals, the last half of the book is occupied with a popular study of the larger and better known animals, chiefly mammals and birds. This part of the book is very abundantly illustrated with figures of the animals mentioned and described, and throughout the illustrations are abundant and good. For the purpose designed this book is open to the criticism that it attempts to crowd rather too much detailed information and too many scientific terms into a short compass. But, on the whole, the style is simple, easily understood by the student for whom the book is designed, and the book seems to be admirably adapted for exciting an interest in zoölogical subjects among students of the secondary grade of schools. The scholar will hardly get a systematic knowledge of zoölogy out of the book, but this could not be expected of any zoölogy adapted to the secondary schools. The work can hardly fail to excite an interest, however, in the scholar and lead him to using his own eyes in the observation of nature, which is, of course, the chief design of scientific instruction in the lower schools. This book can thus certainly be recommended for introduction into high schools and even into schools of lower grade.

Chemical Theory for Beginners. By Leonard Dobbin and James Walker. New York, Macmillan & Co. 8°. 248 p. 70 cents.

The study of chemical theories should be based upon a wide range of experimental facts; and the title of this little volume is unpromising. The theories, however, are supported by numerous experiments. The beginner may find some things hard to understand, but much that is profitable. Those who are familiar with

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Nov. 26.—F. L. O. Wadsworth, Method of Determination of the Metre in Terms of a Wave Length of Light; B. E. Fernow, Recent Contributions Towards the Discussion of Forest Influences; R. T. Hill, The Occurrence of Iron in Mexico.

New York Academy of Sciences, Biological Section.

Nov. 14. — The papers were: Arthur Hollick, On Additions to the Palæobotany of Staten Island. About forty species were presented, of which half had been already described from Greenland Cretaceous and from the Laramie. The fossils, leaf-fragments, fruits, and seeds, occur in fire-brick clay, or in ferruginous sandstone or concretions. The genera notably represented were Populus, Platanus, Myrica, Kalmia, Acer, and Williamsonia. H. F. Osborn, Report upon a Collection of Mammals from the Cretaceous (Laramie). The multituberculates, Meniscoëssus and Ptilodus, were assigned to the Plagiaulacidæ, the former a probable ancestor of Polymastodon. The relations of these mammals were shown to be closer to Puerco than to Upper Jurassic forms. Arthur Willey, On the Significance of the Pituitary Body, and made the suggestion, founded on researches on the Ascidians and Amphioxus, that, if the Amphirhinic condition of the higher vertebrates was preceded by a Monorhinic condition, the nose in the latter case was not represented by the small nasal sac of Petromyzon, of which the unpaired character is undoubtedly secondary, as shown both by its development (Dohrn) and by its nerve-supply; but the nose in the Monorhinic ancestor of the Vertebrates was the organ which we know as the Pituitary Body or Hypophysis cerebri in all existing Vertebrates, this being represented in the Ascidians, as shown by Julin, by the subneural gland and its duct, and in Amphioxus by the so-called olfactory pit. The Pituitary Body is to the lateral Nares what the Pineal Body is to the lateral Eyes. Bashford Dean exhibited an entire Cladodus, a unique specimen recently collected in the Cleveland Shales. The tail, for the first time shown, indicates historically the origin of this part in modern elasmobranches.

Publications Received at Editor's Office.

Addison, Steele and Budgell. Sir Roger de Coverley Papers. English Classics for Schools. New York, American Book Co. 148 p. 12°. 20 cents.

Allsop, F. C. Practical Electric-Light Fitting. New York, Macmillan & Co. 275 p. 12°. $1.50.

Barry. 99 Methods of Utilizing Boiled Beef. Tr. from the French. New York, John Ireland. 122 p. 8°. 75 cents.

Barker, A. S. Deep-Sea Sounding. New York, Wiley. 133 p. Maps. 8°. $2.

Barker, Geo. F. Physics; Advanced Course. Second Edition. New York, Holt. 902 p. 8°.

Campbell, H. J. Elementary Biology. London and New York, Macmillan & Co. 284 p. 12°. $1.60.

Contributions from the Botanical Laboratory of the University of Pennsylvania. Vol. I., No. 1. Philadelphia, University of Pa. 72 p., pl. 8°.

Dingle, Edward. A study of Longitude. Plymouth, Eng., Geo. H. Sellick. 24 p. 8°. 1s.

Galton, Francis. Finger Prints. London and New York, Macmillan & Co. 216 p. 8°. $2.

Hoskins, L. M. Elements of Graphic Statics. London and New York, Macmillan & Co. 191 p., pl. 8°. $2.25.

Irving, Washington. Ten Selections from the Sketch-Book. English Classics for Schools. New York, American Book Co. 149 p. 12°. 20c.

McLennan, Evan. Cosmical Evolution. Chicago, Donohue, Henneberry & Co., 1890. 399 p. 8°.

Scott, Sir Walter. Ivanhoe. English Classics for Schools. New York, American Book Co. 484 p. 12°. 50 cents.

Shakespeare, Wm. Julius Cæsar. English Classics for Schools. New York, American Book Co. 114 p. 12°. 20 cents.

the usual phenomena of chemical action may peruse the work with still more profit. The topics are introduced methodically, beginning with units, states of aggregation, elements and compounds, and conditions of chemical action; but proceeding to the more difficult laws, and giving due notice to such topics as kinetic molecular theory, mass action, dissociation, solution, electrolysis, and the periodic law. Chemical students whose attention has been concentrated on the facts observed in experiment will find these theories very suggestive.

An Introduction to Chemical Theory. By ALEXANDER SCOTT. London and Edinburgh, Adam & Charles Black. 8°. 274 p. $1.25.

THIS volume presents modern views and much valuable information upon the constitution of matter, atomic and molecular weights, classification of elements and compounds, vapor densities, and other physical properties, thermo-chemistry, chemical change, solution, and electrolysis. It claims to be an *introduction* only, although a fair knowledge of chemical facts and experiments is assumed; and it would be unreasonable to expect such completeness as in the works of Ostwald, Meyer, and Naumann. It may prove attractive to many who would be repelled by the more comprehensive works; or, better still, it may awaken a thirst for such exactness of scientific statement as requires more mathematics than Dr. Scott admits into his elementary volume.

AMONG THE PUBLISHERS.

"THE Eighteenth Report of the Geological Survey of Indiana: Palæontology," by S. A. Miller, contains descriptions of a large number of new fossils from various formations, mainly of Upper Silurian and Sub-Carboniferous age. Crinoidea largely predominate, no less than 39 new species and 4 new genera being described. It is unfortunate that some of the species are described from single specimens. All are, however, illustrated. Mr. Miller pays his compliments in his usual way to Professor James Hall and Professor Hyatt. Some of the new species are from the Cincinnati, or Hudson River, group of south-eastern Indiana.

—*St. Nicholas* is universally considered "the best of children's magazines." Contributors for 1893 include John G. Whittier, Edmund C. Stedman, Frank R. Stockton, George W. Cable, Frances Hodgson Burnett, Thos. Wentworth Higginson, George Kennan, Charles Howard Shinn, Laura E. Richards, W. O. Stoddard, Harriet Prescott Spofford, Susan Coolidge, Mary Hallock Foote, Kirk Munroe, Hezekiah Butterworth, President Gilman, Rev. Dr. Lyman Abbott, Howard Pyle, Colonel R. M. Johnston, John Burroughs, H. H. Boyesen, Nora Perry, Poultney Bigelow, Charles F. Lummis, Edith M. Thomas, Kate Douglas Wiggin, and Mary Mapes Dodge.

—Following the principles announced by Teisserenc de Bort, G. Raymond has prepared a little brochure (Paris, Gauthier-Villars) concerning the influence of the chief centres of atmospheric pressure on the prediction of the weather. De Bort laid down his general plan some years ago, and Raymond now presents a number of specific examples that seem to follow in accordance with it; illustrating the conditions for mild winters, moist summers, and so on. The book deserves study by those who have access to our International weather bulletins, and who can undertake the difficult task of generalizing their innumerable facts.

—Henry Collins has written an interesting little pamphlet on "The International Date Line" (Bardeen, Syracuse, 15 cents), giving a chart of the line that runs irregularly through the Pacific, and on either side of which the dates differ by a day. Teachers will find it instructive; although a few matters of fact might have been more fully ascertained before publication, as by correspondence with consuls. The interesting point is raised: Who first celebrate the New Year? It is clearly shown that the 180° meridian from Greenwich has not the importance often given it in the matter of changing dates.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For Sale.—A new Model U. S. Army Hospital Microscope (Zentmayer), also ¼-inch and 1/16-inch Objectives. HENRY C. WELLS, 151 Broadway, New York.

For sale or exchange.—A Stevens' new model pocket shot-gun, 44 cal., with 22-cal. rifle barrel. Just the thing for collecting birds and small mammals. Will exchange for a 22-cal. cane-gun or good books on ornithology. Write for particulars, stating what you have for exchange. R. C. McGREGOR, 2541 Champa st., Denver, Col.

For sale.—A very fine stone sword (?) so named by myself. It is perfect—15 inches in length, a little over 2 inches in width, and ¼ inch thick. It is of a dark slate color, perhaps limestone, and is the largest implement of the kind known. Some fifteen years ago, when it was not mine, I was offered $40 for it; since that time it has come into my possession; that price will now buy it. Address Rev. C. FOSTER WILLIAMS, Ashwood, Tenn.

For exchange.—Fine specimens of Wis. fresh-water pearls. I want books or papers on marine and fresh-water algæ; also classified specimens of same. I will exchange for Smithsonian reports or crystallized minerals. D. M. ANDREWS, Dodge Centre, Minn.

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A POSITION is desired in the South, preferably the Gulf States, where I can teach the sciences. Can also instruct in other branches. Salary only nominal, as I am simply desirous of employment while spending the winter in the South. A private family preferred, but will accept regular school work if not too confining. MORRIS GIBBS, M.D., Kalamazoo, Mich.

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Actinism.
Agriculture, Experimental, Status of.
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Anatomy, The Teaching of, to Advanced Medical Students.
Anthropology, Current Notes on.
Architectural Exhibition in Brooklyn.
Arsenical Poisoning from Domestic Fabrics.
Artesian Wells in Iowa.
Astronomical Notes.
Bacteria, Some Uses of.
Bird on Its Nest, The.
Birds Breeding at Hanover, N. H.
Botanical Laboratory, A.
Botanists, American and Nomenclature.
Brain, A Few Characteristics of the Avian.
Bythoscopidæ and Cercopidæ.
Canada, Royal Society of.
Celts, The Question of the.
Challicotherium, The Ancestry of.
Chemical Laboratory of the Case School.
Children, Growth of.
Collection of Objects Used in Worship.
Cornell, The Change at.
Deaf, Higher Education of the.
Diamonds in Meteorites.
Diphtheria, Tox-Albumin.
Dynamics, Fundamental Hypotheses of.
Electrical Engineer, The Technical Education of.
Eskimo Throwing Sticks.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Eyes, Relations of the Motor Muscles of, to Certain Facial Expressions.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Four-fold Space, Possibility of a Realization of.
Gems, Artificial, Detection of.
Glacial Phenomena in Northeastern New York.
Grasses, Homoptera Injurious to.
Great Lakes, Origin of the Basins of.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hofmann, August Wilhelm von.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Infant's Movements.
Influenza, Latest Details Concerning the Germs of.
Insects in Popular Dread in New Mexico.
Inventions in Foreign Countries, How to Protect.
Inventors and Manufacturers Association.
Iowa Academy of Sciences.
Jargon, The Chinook.
Jassidæ; Notes on Local.
Keller, Helen.
Klamath Nation, Linguistics.
Laboratory Training, Aims of.
Lewis H. Carvill, Work on the Glacial Phenomena.
Lightning, New Method of Protecting Buildings from.
Lion Breeding.
Lissajou's Curves, Apparatus for the Production of.
Maize Plant, Growth and Chemical Composition of.
Maya Codices, a Key to the Mystery of.
Medicine, Preparation for the Study of.
Mineral Discoveries, Washington.
Museums, The Support of.
Palenque Tablet, a Brief Study of.
Patent Office Building, The.
Physa Heterostropha Say, Notes on the Fertility of.
Pict's House, A.
Pocket Gopher, Attempted Extermination of.
Polariscopes, Direct Reflecting.
Psychological Laboratory at Toronto.
Psychological Training, The Need of.
Psylla, the Pear-Tree.
Rain-Making.
Rice-Culture in Japan, Mexico and the United States.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Sistrurus and Crotalophorus.
Star Photography, Notes on.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Weeds as Fertilizing Material.
Weeds, American.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
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